FEDERAL AVIATION AGENCY
Washington 25, D.C.

TECHNICAL STANDARD ORDER

Regulations of the Administrator

Part 514

Subject: AIRBORNE ILS GLIDE SLOPE EQUIPMENT (FOR AIR CARRIER AIRCRAFT) TSO-C34b

Technical Standards Orders for Aircraft Materials, Parts and Appliances

Part 514 which contains minimum performance standards and specifications for materials, parts, and appliances used in aircraft consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. Subpart B contains the technical standards and specifications to which a particular product must conform.

ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D.C.

Subpart A—GENERAL

§ 514.0 Definition of terms.

As used in this part:

(a) "Administrator" means the Administrator of the Federal Aviation Agency or any person to whom he has delegated his authority in the matter concerned.

(b) "FAA" means Federal Aviation Agency.

(c) "Manufacturer" means a person who controls the design and quality of an article produced under the TSO system, including all parts thereof and processes and services related thereto obtained from outside sources.

(d) "Article" means the materials, parts, or appliances for which approval is required under the Civil Air Regulations for use on civil aircraft.

§ 514.1 Basis and purpose.

(a) *Basis.* Section 601 of the Federal Aviation Act of 1958, and §§ 3.18, 4a.31, 4b.18, 5.18, 6.18, 7.18, 10.21, 13.18, and 14.18 of this title (Civil Air Regulations).

(b) *Purpose.* (1) This part prescribes in individual Technical Standard Orders the minimum performance and quality control standards for FAA approval of specified articles used on civil aircraft,[1] and prescribes the methods by which the manufacturer of such articles shall show compliance with such standards in order to obtain authorization for the use of the articles on civil aircraft.

(2) The performance standards set forth in the individual Technical Standard Orders are those standards found necessary by the Administrator to assure that the particular article when used on civil aircraft will operate satisfactorily, or accomplish satisfactorily its intended purpose under specified conditions.

§ 514.2 TSO authorization.

(a) *Privileges.* No person shall identify an article with a TSO marking unless he holds a TSO authorization and the article meets the applicable TSO standards prescribed in this part.

(b) *Letters of acceptance issued prior to July 1, 1962.* An FAA letter of acceptance of a statement of conformance issued for an article prior to July 1, 1962, is an authorization within the meaning of this part and the holder thereof may continue to manufacture such article without obtaining an additional TSO authorization, but shall comply with the requirements of § 514.3 through § 514.10.

(c) *Application.* The manufacturer or his duly authorized representative shall submit an application for a TSO authorization together with the following documents (See Appendix A of this subpart for sample application) to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, in the region in which the manufacturer is located.[2]

(1) A statement of conformance certifying that the applicant has complied with the provisions of Subpart A and the article meets the applicable performance standards established in Subpart B of this part (See Appendix B of this subpart for sample statement of conformance);

(2) Copies of the technical data required in the performance standards set forth in Subpart B of this part for the particular article;

(3) A description of his quality control system in the detail specified in § 1.36 of this title (Civil Air Regulations). In complying with this provision the manufacturer may refer to current quality control data filed with the Agency, as a part of a previous application.

NOTE: When a series of minor changes in accordance with § 514.5 is anticipated, the manufacturer may set forth in his application the basic model numbered article with open brackets after it to denote that suffix change letters will be added from time-to-time e.g., Model No. 100 ( ).

(d) *Issuance.* (1) Upon receipt of the application and adequate supporting documents specified in paragraph (c) of this section to substantiate the manufacturer's statement of conformance with the requirements of this part and his ability to produce duplicate articles in accordance with the provisions of this part, the applicant will be given an authorization to identify his article with the applicable TSO marking.

(2) If the application is deficient in respect to any requirements, the applicant shall, upon request by the Chief, Engineering and Manufacturing Branch, submit such additional information as may be necessary to show compliance with such requirements. Upon the failure of the applicant to submit such additional information within 30 days after the date of the request therefor, his application will be denied and he will be so notified by the Chief, Engineering and Manufacturing Branch.

NOTE: The applicant will be issued an authorization or notified of the denial of his application within 30 days after the date of receipt of such application or, in the event that additional information has been requested, within 30 days after the date of receipt of such additional information.

[1] Articles may also be approved and manufactured for use on civil aircraft as a part of the type design of a type certificate for an aircraft engine or propeller.

[2] Regional Offices are located at New York, Atlanta, Kansas City, Fort Worth, Los Angeles, Anchorage.

§ 514.3 Conditions on authorizations.

The manufacturer of an article under an authorization issued under the provisions of this part shall—

(a) Manufacture such article in accordance with the requirements of Subpart A and the performance standards contained in the applicable TSO of Subpart B of this part;

(b) Conduct the required tests and inspections, and establish and maintain a quality control system adequate to assure that such article, as manufactured, meets the requirements of paragraph (a) of this section and is in a condition for safe operation;

(c) Prepare and maintain for each type or model of such article a current file of complete technical data and records in accordance with § 514.6; and

(d) Permanently and legibly mark each such article with the following information:

(1) Name and address of the manufacturer,

(2) Equipment name, or type or model designation,

(3) Weight to the nearest tenth of a pound,

(4) Serial number and/or date of manufacturer, and

(5) Applicable Technical Standard Order (TSO) number.

§ 514.4 Deviations.

Approval for a deviation from the performance standards established in Subpart B may be obtained only if the standard or standards for which deviation is requested are compensated for by factors or design features which provide an equivalent level of safety. A request for such approval together with the pertinent data shall be submitted by the manufacturer to the Chief, Engineering and Manufacturing Branch of the Region in which the applicant is located.

§ 514.5 Design changes.

(a) *By Manufacturer*—(1) *Minor changes.* The manufacturer of an article under an authorization issued pursuant to the provisions of this part may make minor design changes to the article without further approval by the FAA. In such case the changed article shall retain the original model number and the manufacturer shall forward to the Chief, Engineering and Manufacturing Branch such revised data as may be necessary for compliance with § 514.2(c).

(2) *Major changes.* If the changes to the article are so extensive as to require a substantially complete investigation to determine compliance with the performance standards established in Subpart B, the manufacturer shall assign a new type or model designation to the article and submit a new application in accordance with the provisions of § 514.2(c).

(b) *By persons other than the manufacturer.* Design changes to an article by a person other than the manufacturer who submitted the statement of conformance for such article are not eligible for approval under this part, unless such person is a manufacturer as defined in § 514.0 and applies for authorization under § 514.2(c).

NOTE: Persons other than a manufacturer may obtain approval for design changes to a product manufactured under a TSO pursuant to the provisions of Part 18 or the applicable airworthiness regulations.

§ 514.6 Retention of data and records.

(a) A manufacturer holding an authorization issued pursuant to the provisions of this part shall, for all articles manufactured under such authorization on and after July 1, 1962, maintain and keep at his factory:

(1) A complete and current technical data file for each type or model of article which shall include the design drawings and specifications. This technical data shall be retained for the duration of his operation under the provisions of this part.

(2) Complete and current inspection records to show that all inspections and tests required to ensure compliance with this part have been properly accomplished and documented. These records shall be retained for at least two years.

(b) The data specified in paragraph (a)(1) of this section shall be identified and copies transferred to the FAA for record purposes in the event the manufacturer terminates his business or no longer operates under the provisions of this part.

§ 514.7 Inspection and examination of data, articles or manufacturing facilities.

The manufacturer shall, upon request, permit an authorized representative of the FAA to inspect any article manufactured pursuant to this part, and to observe the quality control inspections and tests and examine the manufacturing facilities and technical data files for such article.

§ 514.8 Service difficulties.

Whenever the investigation of an accident or a service difficulty report shows an unsafe feature or characteristic caused by a defect in design or manufacture of an article, the manufacturer shall upon the request of the Chief, Engineering and Manufacturing Branch, report the results of his investigation and the action, if any, taken or proposed by him to correct the defect in design or manufacture (e.g., service bulletin, design changes, etc.). If the defect requires a design change or other action to correct the unsafe feature or characteristic, the manufacturer shall submit to the Chief, Engineering and Manufacturing Branch, the data necessary for the issuance of an airworthiness directive containing the appropriate corrective action.

§ 514.9 Noncompliance.

Whenever the Administrator finds that a manufacturer holding an authorization issued pursuant to the provisions of this part has identified an article by a TSO marking and that such article does not meet the applicable performance standards of this part, the Administrator may, upon notice thereof to the manufacturer, withdraw the manufacturer's authorization and, where necessary, prohibit any further certification or operation of a civil aircraft upon which such article is installed until appropriate corrective action is taken.

§ 514.10 Transferability and duration.

An authorization issued pursuant to the provisions of this part shall not be transferred and is effective until surrendered, or withdrawn, or otherwise terminated by the Administrator.

APPENDIX A

SAMPLE APPLICATION FOR TSO AUTHORIZATION

_____
(Date)

(Addressed to: Chief, Engineering and Manufacturing Branch, Federal Aviation Agency, Region.)

Application is hereby made for authorization to use the Technical Standard Order procedures.

Enclosed is a statement of conformance for the article to be produced under TSO–C_____.

The required quality control data [1] are transmitted: (herewith) (under separate cover).

Signed _____

APPENDIX B

SAMPLE STATEMENT OF CONFORMANCE

_____
(Date)

(Addressed to: Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency.)

The undersigned hereby certifies that the article listed below by model, type or part number has been tested and meets the performance standards of Technical Standard Order C_____. In addition, all other applicable provisions of Part 514 of the Regulations of the Administrator have been met.

The technical data required by the TSO in the quantity specified are transmitted: (herewith) (under separate cover).

Authorization to use TSO identification on this article is requested.

Signed _____

[1] Reference may be made to data already on file with the FAA.

§ 514.60 Airborne ILS glide slope receiving equipment (for air carrier aircraft) - TSO-C34b.

(a) Applicability. (1) Minimum performance standards are hereby established for airborne ILS glide slope receiving equipment which is to be used on civil aircraft of the United States engaged in air carrier operations. New models of airborne ILS glide slope receiving equipment manufactured for use on civil air carrier aircraft on or after the effective date of this section shall meet the minimum performance standards contained in Federal Aviation Agency Standard entitled "Minimum Performance Standards for Airborne ILS Glide Slope Receiving Equipment", dated May 9, 1962, and Radio Technical Commission for Aeronautics Paper 120-61/DO-108[1/] entitled, "Environmental Test Procedures Airborne Electronic Equipment", dated July 13, 1961, with the exceptions to these standards as listed in subparagraph (2) of the paragraph.

(2) Radio Technical Commission for Aeronautics Paper 120-61/DO-108 outlines various test procedures which define the environmental extremes over which the equipment shall be designed to operate. Some test procedures have categories established and some do not. Where categories are established, only equipment which qualifies under the following categories, as specified in RTCA Paper 120-61/DO-108, is eligible under this order:

(i) Temperature-Altitude Test - Categories A, B, C, or D;

(ii) Humidity Test - Categories A or B;

(iii) Vibration Test - Categories A, B, C, D, E, or F;

(iv) Audio-Frequency Magnetic Field Susceptibility Test - Categories A or B;

(v) Radio-Frequency Susceptibility Test - Category A; and

(vi) Emission of Spurious Radio-Frequency Energy Test - Category A.

(b) Marking. (1) In addition to the markings specified in § 514.3(d), the equipment shall be marked to indicate the environmental extremes over which it has been designed to operate. There are seven environmental test procedures outlined in RTCA Paper 120-61/DO-108 which have categories established. These should be identified on the nameplate by the words "environmental categories" or, as abbreviated, "Env. Cat." followed by seven letters which identify the categories designated in RTCA Paper 120-61/DO-108. Reading from left to right, the category designations shall appear on the nameplate in the following order so that they may be readily identified:

(i) Temperature-Altitude Test Category;

(ii) Humidity Test Category;

1/Copies of this paper may be obtained from the RTCA Secretariat, Room 1072, T-5 Building, 16th and Constitution Avenue, N. W., Washington 25, D. C. at a cost of 75 cents per copy.

(iii) Vibration Test Category;

(iv) Audio-Frequency Magnetic Field Susceptibility Test Category;

(v) Radio-Frequency Susceptibility Test Category;

(vi) Emission of Spurious Radio-Frequency Energy Test Category; and

(vii) Explosion Test.

(2) Equipment which meets the explosion test requirement shall be identified by the letter "E". Equipment which does not meet the explosion test requirement shall be identified by the letter "X". A typical nameplate identification would be as follows: Env. Cat. DABAAAX.

(3) In some cases such as under the Temperature-Altitude Test Category, a manufacturer may wish to substantiate his equipment under two categories. In this case, the nameplate shall be marked with both categories in the space designated for that category by placing one letter above the other in the following manner: Env. Cat. $\frac{A}{D}$ABAAAX.

(4) Each major component of equipment (antenna, power supply, etc.) shall be identified with at least the manufacturers' name, TSO number, and the environmental categories over which the equipment component is designed to operate.

(c) Data requirements. Six copies each of the following, except where noted, together with the statement of conformance, shall be furnished to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency, in the region in which the manufacturer is located:

(1) Manufacturer's operating instructions and equipment limitations.

(2) Installation procedures with applicable schematic drawings, wiring diagrams, and specifications. Indicate any limitations, restrictions, or other conditions pertinent to installation.

(3) One copy of the manufacturer's test report.

(d) Effective date. May 28, 1963.

FEDERAL AVIATION AGENCY

WASHINGTON, D.C.

MINIMUM PERFORMANCE STANDARDS FOR AIRBORNE ILS GLIDE SLOPE RECEIVING EQUIPMENT

MAY 9, 1962

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INTRODUCTION

This document sets forth minimum performance standards for airborne ILS glide slope receiving equipment.

Compliance with these standards by manufacturers and users is required as a means of assuring that the equipment will satisfactorily perform its intended function.

Inasmuch as the measured values of radio equipment performance characteristics may be a function of the method of measurement, standard test conditions and methods of test are also included in this document.

The word "equipment" as used herein includes all of the components or units necessary (as determined by the equipment manufacturer) for the equipment to perform properly its intended function. For example, an airborne ILS glide slope receiving "equipment" may include an antenna, a receiver unit, a control box, a power supply, a shock mount, etc. In the case of this example, all of the foregoing components or units comprise the "equipment". It should not be inferred from this example, however, that every airborne ILS glide slope receiving equipment will necessarily include all of the foregoing components. This will depend on the design used by the equipment manufacturer.

MINIMUM PERFORMANCE STANDARDS
AIRBORNE ILS GLIDE SLOPE RECEIVING EQUIPMENT

1.0 GENERAL STANDARDS

1.1 Rating of Components

The equipment shall not incorporate in its design any components of such rating that, when the equipment is operated throughout the range of the specified environmental tests, the rating established by the manufacturer of the component is exceeded. For electron tubes, the continuous commercial service rating of the tube manufacturer is applicable except for the heaters and filaments. The voltage applied to the heaters and filaments of electron tubes shall be within 5% of the manufacturer's rating when the equipment is operated under standard operating conditions. When the heaters and filaments are connected in series, the 5% tolerance shall apply to the sum of their voltage ratings.

1.2 Operation of Controls

The design of the equipment shall be such that the controls intended for use during flight cannot be operated in any possible position combination or sequence which would result in a condition whose presence or continuation would be detrimental to the reliability of the equipment.

1.3 Effects of Test

Unless otherwise provided, the design of the equipment shall be such that, subsequent to the application of the specified tests, no discernible condition exists which would be detrimental to the continued performance of the equipment.

1.4 Accessibility of Controls

Controls which are not normally adjusted in flight shall not be readily accessible to flight personnel.

1.5 Deviation Indicator Deflection Range

The deviation indicator shall be capable of deflecting at least five-eighths of an inch on both sides of its center zero position. In the case of "cross pointer" type instruments, the reference deflection line shall be the centered localizer deviation indicator needle. In the case of other type indicators, the reference deflection line shall be its scale.

2.0 MINIMUM PERFORMANCE STANDARDS UNDER STANDARD TEST CONDITIONS

The test procedures applicable to a determination of the performance of airborne ILS glide slope receiving equipment under standard test conditions are set forth in Appendix "A" of this report.

2.1 Voltage Standing Wave Ratio (Receiver)

The voltage standing wave ratio on the transmission line connecting the receiver and the signal source shall not exceed a value of 10 over the radio-frequency range from 329.0 to 335.3 Mc.

2.2 Voltage Standing Wave Ratio (Antenna)

The voltage standing wave ratio on the transmission line connecting the antenna and a signal source, shall not exceed a value of 6 over the radio-frequency range from 329.0 to 335.3 Mc.

2.3 Centering Characteristic

The deviation indicator shall not depart from its centered position by more than 5% of the standard deflection when the level of a standard glide slope *centering* signal is varied over the range of 100 to 30,000 μv.

2.4 Sensitivity

The sensitivity of the receiver, as defined in Appendix A, paragraph *k*, shall not be less than 40 μv.

2.5 Deflection Characteristics

When the receiver has been adjusted to produce deviation indicator standard deflection with a 700 μv standard glide slope *deviation* signal, the deviation indicator deflection with an input signal of 14,000 μv, shall be within +5% and −15% of the standard deflection.

2.6 Deflection Balance

When the receiver has been adjusted to produce deviation indicator standard deflection with a 700 μv standard glide slope *deviation* signal, 90 cps greater than 150 cps, the deviation of opposite polarity obtained when the signal is modulated with 150 cps greater than 90 cps shall be within 4% of standard deflection.

2.7 Deflection Linearity

Over the deflection range of the deviation indicator, the amount of deflection shall be within 10% of being proportional to the difference in depth of modulation* of the 90 and 150 cps signals, or the amount of deflection shall be within 5% of standard deflection of being proportional to the difference in depth of modulation, whichever is greater. Additionally, as the difference in depth of modulation is increased beyond that producing full scale deflection to a value of .9 ddm, the indicator deflection shall not be less than full scale. These standards shall be met over the range of signal input level from 200 to 30,000 μv.

2.8 Selectivity

The receiver shall meet the following selectivity standards on each frequency channel:

a. Over the frequency range from center response frequency** −60 kc to center response frequency +60 kc, the response shall not vary more than 6 db.

b. Over the frequency range from 230 kc to 530 kc from the center response frequency, the response shall be at least 40 db down from the response at the frequency of maximum response.

c. Over the frequency range from 328.77 Mc to 335.53 Mc, excluding frequencies between ±530 kc of center response frequency, the response shall be at least 60 db below the response at center response frequency.

2.9 Spurious Response

The receiver shall meet the following spurious response standard on each frequency channel:

The response of the receiver shall be at least 60 db below the response at center response frequency when an input signal modulated 30% at 150 cps is varied over the frequency range of 90 kc to 1500 Mc, excluding the frequency band 328.77 Mc to 335.53 Mc.

2.10 Cross Modulation

With the simultaneous application of a standard glide slope *centering* signal at maximum response frequency (desired signal) and a signal, consisting of an rf carrier amplitude modulated 30% at 150 cps, at other than maximum response frequency (undesired signal), the deviation indicator shall not deflect from its centered position due to cross modulation by more than 10% of standard deflection under the following conditions:

Level of Desired Signal	*Level of Undesired Signal*	*Frequency Range over which Undesired Signal is Varied*
200 μv	20,000 μv	329.0 Mc–335.3 Mc, excluding desired signal frequency ±300 kc
1000 μv	20,000 μv	329.0 Mc–335.3 Mc, excluding desired signal frequency ±300 kc

2.11 Alarm Signal

An alarm signaling device shall be provided. The alarm signal shall:

a. Be plainly visible in the absence of an rf signal and in the absence of 90 and 150 cps modulation on a 700 μv carrier at center response frequency.

* Difference in depth of modulation (ddm) is the percentage modulation depth of the larger signal minus the percentage modulation depth of the smaller signal divided by 100.

** Center response frequency is the frequency midway between the two frequencies at which the selectivity curve is 6 db down.

b. At least begin to appear when the percentage modulation of the 90 and 150 cps signals of a 700 μv standard glide slope *centering* signal is reduced to 22.5% of each and when the percentage modulation of either the 90 or 150 cps signal is zero and the other 45%.

c. At least begin to appear when the level of a standard glide slope *deviation* signal produces 50% of standard deflection of the deviation indicator.

d. Be energized and its indicator off or out of sight when the level of a standard glide slope test signal is varied over the range of at least 40 to 30,000 μv.

2.12 Emission of Spurious Radio-Frequency Energy

The levels of conducted and radiated spurious radio-frequency energy emitted by the equipment shall not exceed those levels specified in Appendix A of RTCA Paper 120-61/DO-108—"Environmental Test Procedures—Airborne Electronic Equipment", dated July 13, 1961, for the aircraft category for which the equipment is designed.

2.13 Damping Characteristics

When a standard glide slope test signal of 700 μv is abruptly changed from a standard *centering* signal to a standard *deviation* signal, the indicator shall, in not more than two seconds, move to the point which is removed from the final stabilized position of the indicator by a distance equal to 10% of standard deflection. The initial "overshoot" of the indicator shall not exceed 2% of standard deflection.

NOTE: The amount of damping required for satisfactory service operation of a glide slope receiver may exceed the amount specified above. The additional damping may be provided through adjustment within the receiver or through external damping means.

2.14 Power Source Frequency Variation

When the receiver is designed for operation from an AC power source of variable frequency and the frequency is slowly varied through the range for which the receiver is designed, the deviation indicator needle shall not vary more than 5% of standard deflection in the presence of a standard glide slope *centering* signal of 200 μv.

2.15 Deviation Indicator Stability with Change in Frequency of 90 and 150 cps Signals

a. The deviation indicator shall not change from its centering position by more than 5% of standard deflection when the frequency of the modulation signals of a 700 μv standard glide slope *centering* signal is simultaneously varied over the range from 97.5% to 102.5% of 90 and 150 cps.

b. The deviation indicator shall not depart from standard deflection by more than 15% of standard deflection when the frequency of the modulation signals of a 700 μv standard glide slope *deviation* signal is simultaneously varied over the range from 97.5% to 102.5% of 90 and 150 cps.

2.16 Deviation Indicator Sensitivity Adjustment Range

Means shall be provided for the adjustment of the deviation indicator deflection sensitivity. The range of adjustment shall be at least from .4 to .8 of full scale deflection of the deviation indicator when the input signal is a standard glide slope *deviation* signal of 700 μv. At all sensitivity settings over the range from .4 to .8 of full scale, the standards of Sections 2.3, 2.4, 2.5, 2.6, and 2.7 shall be met except that, in this case, reference deflection shall be the deflection obtained with a standard glide slope *deviation* signal of 700 μv at the particular deflection sensitivity setting.

2.17 Operation of Two Glide Slope Receivers from the Same Antenna

(This standard is applicable to those receivers designed to operate from an antenna which also supplies signals to another receiver.)

When the receiver is connected, in accordance with the manufacturer's instructions, to an antenna which also supplies

signals to another glide slope receiver and both receivers are operated in accordance with the manufacturer's instructions, the standards of all paragraphs of Section 2 shall be met, and the deviation indication inaccuracies resulting from interaction between the two receivers when operated on the same rf frequency shall not exceed 5% of standard deflection.

For the purpose of this standard, the junction of the two transmission lines connected to the receivers shall be considered the receiver input.

NOTE: It is recognized that two receivers meeting the above standard may interfere with one another on some combinations of channel settings. While it is desirable that two receivers so connected cannot interfere with one another at all channel setting combinations, the state of the art is such that it is impracticable to set forth an equipment standard in these terms as a minimum requirement. It is recommended that equipment manufacturers take cognizance of this and make a determined effort to reduce the number of channel setting combinations where interference might occur and to reduce the severity of the interference in those cases where it cannot be eliminated.

2.18 Deviation Indicator Stability with Change in 90/150 cps Modulation Percentage

The deviation indicator shall not change from its centered position by more than 5% of standard deflection when the modulation percentage of a 200 μv standard glide slope *centering* signal is varied from 40% (each frequency) to 47.5% (each frequency), the ddm being maintained as specified in Appendix A.

2.19 90 and 150 cps Phase Characteristic

The deviation indicator shall not change from its centered position by more than 5% of standard deflection when a standard glide slope *centering* signal of 200 μv is applied to the receiver input and the phase relationship between the 90 and 150 cps signals is varied continuously from the correct phasing (see Appendix A, Par. *i*) $\pm 12°$ of the common 30 cps subharmonic. At the points of plus and minus 12° shift of one of the frequencies with respect to the other, the modulation percentage of the rf carrier will be a maximum.

2.20 Frequency Channel Selection

The receiver shall be designed to select, in discrete increments, the frequency channels allocated for use in the glide slope portion of the ILS system. The accuracy of frequency channel selection shall be such that the center response frequency of the receiver shall be within 45 kc of the center frequency of the respective frequency channel.

NOTE: In the ILS system, the frequency channels allocated for the localizer facilities are paired with those allocated for the glide slope facilities. Usually, a single selector switch is used in the aircraft to select the various paired frequency channel combinations.

3.0 MINIMUM PERFORMANCE STANDARDS UNDER ENVIRONMENTAL TEST CONDITIONS

Unless otherwise specified, the test procedures, applicable to a determination of the performance of this equipment under environmental test conditions are set forth in RTCA Paper 120-61/DO-108—"Environmental Test Procedures — Airborne Electronic Equipment", dated July 13, 1961.

3.1 Temperature Altitude Test

3.1.1 *Low Temperature Test*

When subjected to this test:

a. The receiver sensitivity, as defined in Appendix A, paragraph *k*, shall be 80 μv or better.

b. The deviation indicator deflection, with a 200 μv standard glide slope *centering* signal, shall not change from that obtained under standard test conditions by more than 5% of standard deflection.

c. The deviation indicator deflection, with a 700 μv standard glide slope *deviation* signal, shall not change from that obtained under standard test conditions by more than 15% of standard deflection.

3.1.2 *High Temperature Test*

a. When the equipment is operated at the High Short-Time Operating Temperature:

(1) All mechanical devices shall operate satisfactorily.

(2) There shall be no evidence of materials, such as grease or potting and sealing compounds, exuding or dripping from the equipment components.

b. When the equipment is operated at the High Operating Temperature:

(1) The receiver sensitivity, as defined in Appendix A, paragraph *k*, shall be 80 μv or better.

(2) The deviation indicator deflection, with a 700 μv standard glide slope *centering* signal, shall not change from that obtained under standard test conditions by more than 5% of standard deflection.

(3) The deviation indicator deflection, with a 700 μv standard glide slope *deviation* signal, shall not change from that obtained under standard test conditions by more than 15% of standard deflection.

3.1.3 *Decompression Test (When Required)*

Following the decompression portion of the test, the standards of paragraphs 2.3, 2.4, 2.5 and 2.6 shall be met.

3.1.4 *Altitude Test*

When the equipment is subjected to the altitude test, the standards of paragraphs 2.3, 2.4, 2.5 and 2.6 shall be met.

3.2 Humidity Test

After subjection to humidity and

a. Within 15 minutes from the time primary power is applied, the sensitivity shall be within 4:1 of that obtained under standard test conditions. The deviation indicator deflection, with a standard glide slope *centering* signal of 200 μv, shall not exceed 15% of standard deflection. The deviation indicator deflection, with a standard glide slope *deviation* signal of 700 μv, shall not depart from standard deflection by more than 30% of standard deflection.

b. Within four hours from the time primary power is applied, the sensitivity shall be within 1.25:1 or ± 2 μv, whichever is greater, of that obtained under standard test conditions. The deviation indicator deflection, with a standard glide slope *centering* signal of 200 μv, shall not exceed 3% of standard deflection; and the deviation indicator deflection, with a standard glide slope *deviation* signal of 700 μv, shall not depart from standard deflection by more than 5% of standard deflection.

3.3 Shock Test

a. Following the application of the Operational Shocks, the requirements of paragraphs 2.3, 2.4, 2.5 and 2.6 shall be met.

b. Following the application of the Crash Safety Shocks, the equipment shall have remained in its mounting and no part of the equipment or its mounting shall have become detached and free of the shock test table or of the equipment under test.[1]

3.4 Vibration Test

When the equipment is subjected to the vibration test, the standards of paragraphs 2.3, 2.4, 2.5 and 2.6 shall be met.

3.5 Temperature Variation Test

When subjected to this test:

a. The center response frequency of the receiver shall remain within 45 kc of the assigned channel frequency.

b. The deviation indicator deflection, with a 200 μv standard glide slope *centering* signal, shall not change from that obtained under standard test conditions by more than 5% of standard deflection.

c. The deviation indicator deflection, with a 700 μv standard glide slope

[1] The application of this test and that required by paragraph 3.6(c) may result in damage to the equipment under test. Therefore, they may be conducted after the other tests are completed. Paragraph 1.3 does not apply.

deviation signal, shall not change from that obtained under standard test conditions by more than 15% of standard deflection.

3.6 Low Voltage Test

a. When the primary power voltage(s) of DC operated equipment is 80% and when that of AC operated equipment is 87½% of standard test voltage(s), the equipment shall operate electrically and mechanically. Degradation of performance is tolerable.

b. DC operated equipment shall operate satisfactorily within two (2) minutes upon returning the primary power voltage(s) to normal, after the gradual reduction of the primary voltage(s) from 80% to 50% of standard test voltage(s).

c. The gradual reduction of the primary power voltage(s) of DC operated equipment from 50% to 0% of standard test voltage(s) shall produce no evidence of the presence of fire or smoke.[2]

[2] The application of this test and that required by paragraph 3.3(*b*) may result in damage to the equipment under test. Therefore, they may be conducted after the other tests are completed. Paragraph 1.3 does not apply.

3.7 Conducted Voltage Transient Test

a. Following the Intermittent Transient test, the requirements of paragraphs 2.3, 2.4 and 2.5 shall be met.

b. When the Repetitive Transient Test is applied, the requirements of paragraphs 2.3, 2.4 and 2.5 shall be met.

3.8 Conducted Audio-Frequency Susceptibility Test

When subjected to this test, the requirements of paragraphs 2.3, 2.4 and 2.5 shall be met.

3.9 Audio-Frequency Magnetic Field Susceptibility Test

When subjected to this test, the requirements of paragraphs 2.3, 2.4 and 2.5 shall be met.

3.10 Radio-Frequency Susceptibility Test (Radiated and Conducted)

When the equipment is subjected to this test, the standards of paragraphs 2.3, 2.4 and 2.5 shall be met, excepting within the band of ±300 kc of the frequency to which the receiver is tuned.

3.11 Explosion Test (When Required)

During the application of this test, the equipment shall not cause detonation of the explosive mixture within the test chamber.

APPENDIX A

TEST PROCEDURES
AIRBORNE ILS GLIDE SLOPE RECEIVING EQUIPMENT

NOTE

THE TEST PROCEDURES SET FORTH IN PART II OF THIS APPENDIX ARE SATISFACTORY FOR USE IN DETERMINING THE PERFORMANCE OF AIRBORNE ILS GLIDE SLOPE RECEIVING EQUIPMENT. *TEST PROCEDURES WHICH PROVIDE EQUIVALENT INFORMATION MAY BE USED.*

PART I

DEFINITIONS OF TERMS AND CONDITIONS OF TEST

The following Definitions of Terms and Conditions of Test are applicable to the receiving equipment tests specified herein.

a. Power Input Voltage

Unless otherwise specified, all tests shall be conducted with the power input voltage adjusted to design voltage ±2%. The input voltage shall be measured at the receiver input terminals.

NOTE: Design voltages in use as of the date of this report are 13.75 v DC, 27.5 v DC, and 115 v AC.

b. Power Input Frequency

(1) In the case of receivers designed for operation from an AC power source of essentially constant frequency (e.g., 400 cps), the input frequency shall be adjusted to design frequency ±2%.

(2) In the case of equipment designed for operation from an AC power source of variable frequency (e.g., 300 to 1000 cps), unless otherwise specified, tests shall be conducted with the input frequency adjusted to within 5% of a selected frequency and within the range for which the equipment is designed.

c. Adjustment of Equipment

The circuits of the equipment under test shall be properly aligned and otherwise adjusted in accordance with the manufacturer's recommended practices prior to the application of the specified tests.

d. Test Instrument Precautions

Due precautions shall be taken during the conduct of the tests to prevent the introduction of errors resulting from the improper connection of headphones, voltmeters, oscilloscopes, and other test instruments across the input and output impedances of the equipment under test.

e. Ambient Conditions

Unless otherwise specified, all tests shall be conducted under conditions of ambient room temperature, pressure, and humidity. However, the room temperature shall be not lower than 10° C.

f. Warm-up Period

Unless otherwise specified, all tests shall be conducted after a warm-up period of not less than fifteen (15) minutes.

g. Connected Load

Unless otherwise specified, all tests shall be performed with the equipment connected to loads having the impedance value for which it is designed.

Typical Maximum Loads:

Deviation Indicator:	Three 1000 ohm movements in parallel; net 333 ohm load.
Alarm Indicator (Flag):	Two 1000 ohm movements in parallel; net 500 ohm load.

NOTE: D.I. and flag currents specified are in each of the several movements noted above

h. RF Input Load

The "RF input voltage" is defined as the "open circuit" voltage of the circuit connected to the receiver input. The circuit connected to the receiver input shall be the equivalent of the RF input voltage in series with an impedance having a resistance within 10% and a reactance of not more

than 10% of the characteristic impedance of the transmission line for which the receiver is designed.

NOTE: The RF input voltages specified herein are for the case of a receiver designed for a transmission line having a nominal characteristic impedance of 52 ohms. In the case of a receiver designed for a transmission line having a nominal characteristic impedance of other than 52 ohms, the RF input voltage values shall be computed according to the following equation:

$$E_2 = \sqrt{E_1^2 \frac{R_2}{52}}$$

Where E_2 is the rf input voltage to be used in the case of a receiver designed for a transmission line having a nominal characteristic impedance other than 52 ohms—

E_1 is the rf input voltage specified herein—

R_2 is the nominal characteristic impedance of the transmission line for which the receiver is designed.

i. Standard Test Signals

Refer to RTCA Paper 208–53/DO–52—"Calibration Procedures for Signal Generators Used in the Testing of VOR and ILS Receivers." Unless otherwise specified, the RF input signals shall be as follows:

Standard Glide Slope Test Signal

An rf carrier amplitude modulated simultaneously with 90 and 150 cps ±.3% signals so that the sum of their separate modulation levels equals 90 ±2%.

Standard Glide Slope Centering Signal

A standard glide slope test signal in which the difference in depth of modulation* of the 90 and 150 cps signals is less than .002.

Standard Glide Slope Deviation Signal

A standard glide slope test signal in which the difference in depth of modulation* of the 90 and 150 cps signals is 0.105 ±.002.

Phase Relationship of 90 and 150 cps Modulation

Refer to RTCA Paper 208–53/DO–52, paragraph 5.6 for detailed description of 90/150 cps phase relationships, their measurements and adjustment.

j. Standard Deflection

"Standard Deflection" shall be .52 (78 μa) of center to full scale deflection of the deviation indicator. The receiver shall be adjusted to produce standard deflection when the input signal is a standard glide slope *deviation* signal of 700 μv.

NOTE: The 78 μa figure refers to the condition in which the instrument full-scale deflection is 150 μa.

k. Receiver Sensitivity

The receiver sensitivity is the minimum level in microvolts of a standard glide slope *deviation* signal required to produce simultaneously (1) a deflection of the deviation indicator of at least 60% of standard deflection, and (2) erratic movement of the deviation indicator due to noise of not more than ±5% of standard deflection.

* Difference in depth of modulation (ddm) is the percentage modulation depth of the larger signal minus the percentage modulation depth of the smaller signal divided by 100.

PART II

DETAILED TEST PROCEDURES

T–1 VOLTAGE STANDING WAVE RATIO (Receiver)

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Slotted Line having an impedance equal to that for which the receiver input is designed.

An Impedance Bridge may be used in lieu of the slotted line.

Measurement Procedure

a. Slotted Line Method:

With the receiver operating and the slotted line connected to the receiver input, apply an rf signal to the input of the slotted line. Measure the minimum and maximum rf voltages along the slotted line and compute the VSWR.

The level of the input signal shall not be high enough to overload the receiver input circuit.

b. Impedance Bridge Method:

With the impedance bridge, measure the impedance of the receiver input circuit and compute the VSWR.

The level of the input signal shall not be high enough to overload the receiver input circuit.

T–2 VOLTAGE STANDING WAVE RATIO (Antenna)

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Slotted Line having an impedance equal to that for which the antenna input is designed.

An Impedance Bridge may be used in lieu of the slotted line.

Measurement Procedure

a. Slotted Line Method:

Apply to the antenna input, through the slotted line, an rf signal. Measure the minimum and maximum rf voltages along the slotted line and compute the VSWR.

b. Impedance Bridge Method:

With the impedance bridge, measure the impedance of the antenna input circuit and compute the VSWR.

T–3 CENTERING CHARACTERISTIC

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope *centering* signal. Vary the signal input level over the range of 100 to 30,000 μv. Determine the maximum deviation of the indicator from its centered position.

T–4 SENSITIVITY

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope *deviation* signal. Determine the minimum rf signal input level required to produce simultaneously:

a. A deflection of the deviation indicator of at least 60% of standard deflection.

b. Erratic movement of the deviation indicator due to noise of not more than ±5% of standard deflection.

T–5 DEFLECTION CHARACTERISTIC

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope *deviation* signal. Adjust the receiver for standard deflection with an rf input signal level of 700 microvolts. Determine the change of deviation indicator deflection when the level of the input signal has been increased to 14,000 microvolts.

T–6 DEFLECTION BALANCE

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope *deviation* signal (90 cps modulating signal greater than 150 cps signal). With an rf input signal of 700 microvolts, adjust the receiver for standard deflection. Using the same rf input signal level, apply to the receiver input a standard glide slope *deviation* signal in which the 150 cps modulating signal is greater than the 90 cps signal. Determine the difference between the deflection of the indicator and standard deflection.

T–7 DEFLECTION LINEARITY

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope test signal. Vary the difference in depth of modulation of the 90 and 150 cps signals over the range of 0 to .9 ddm and determine the proportionality of the difference in depth of modulation to deviation indicator deflection up to full scale deflection. For values of difference in depth of modulation beyond that producing full scale deflection, determine whether the deviation indicator moves off of the full scale position. This test shall be conducted at rf input signal levels of 200, 1000, 10,000 and 30,000 μv.

T–8 SELECTIVITY

Equipment Required

RF Signal Generator (Boonton Model 211–A or equivalent).

Audio Signal Generator (Collins Model 479S or equivalent).

Univerter (Boonton Model 212–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

a. Apply to the receiver input a standard glide slope *deviation* signal and determine the input signal level at the frequency of maximum response required to produce de-

flection equal to .6 of standard deflection. Note this value of input signal. Vary the radio-frequency of the input signal over the range from −60 kc to +60 kc from center response frequency and determine the maximum change in input signal level over this range required to produce a deviation indicator deflection of .6 of standard deflection. Compute the db change in level of the input signal.

b. Vary the radio-frequency to the input signal over the ranges from −530 kc to −230 kc from center response frequency and from +230 kc to +530 kc from the center response frequency. Determine the minimum level of input signal over these frequency ranges required to produce deviation indicator deflection of .6 of standard deflection. Compute the difference in db from the signal input level required to produce .6 of standard deflection at center response frequency.

c. Vary the radio-frequency of the input signal over the range from 328.77 Mc to 335.53 Mc, excluding the frequencies from −530 kc from center response frequency to +530 kc from center response frequency. Determine the minimum input over this frequency range required to produce indicator deflection equal to .6 of standard deflection. Compute the db change in signal level from that required to produce deviation indicator deflection equal to .6 of standard deflection at the center response frequency.

T–9 SPURIOUS RESPONSE

Equipment Required

RF Signal Generators (General Radio Model 805–C and Hewlett-Packard Models 608–A, 610–B, and 614–A or equivalent).

AF Signal Generator (Hewlett-Packard Model 200 or equivalent).

Measurement Procedure

Apply to the receiver input an rf signal modulated 30% at 150 cps and having a level 60 db greater than that producing .6 of standard deflection at center response frequency. Vary the radio-frequency of the input signal over the range from 90 kc to 1500 Mc, excluding the band 328.77 Mc to 335.53 Mc, and determine whether the indicator deflection exceeds .6 of standard deflection over this frequency range.

T–10 CROSS MODULATION

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

RF Signal Generator (Boonton Model 211–A or equivalent).

AF Signal Generator (Collins Model 479S or equivalent).

Univerter (Boonton Model 212A or equivalent).

Combining Unit (See Figure 1).

Measurement Procedure

Connect the two RF signal generators together by means of the combining unit. Apply simultaneously to the receiver input a standard glide slope *centering* signal having a level of 200 μv at maximum response frequency (desired signal) and a signal consisting of an rf carrier amplitude modulated 30% of 150 cps and having a level of 20,000 μv (undesired signal).

Vary the radio-frequency of the undesired signal over the range from 329.0 Mc to 335.3 Mc, excluding the band from −300 kc of maximum response frequency to +300 kc from maximum response frequency.

Determine the maximum amount of deflection of the deviation indicator from its centered position due to cross modulation. Repeat this test with the level of the desired signal at 1000 μv and the level of the undesired signal at 20,000 μv.

T–11 ALARM SIGNAL

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope test signal having a level of 700 μv. Determine the position or response of the alarm signal under the following conditions:

a. When the 90 and 150 cps modulation is removed from the carrier.

b. (1) When the modulation levels of each of the 90 and 150 cps signals is reduced to 22.5%.

(2) When the modulation level of either the 90 or 150 cps signal is zero and the other is 45%.

c. When the level of the standard glide slope *deviation* signal is reduced to that which produces 50% of standard deflection.

d. When the level of the standard glide slope test signal is varied over the range from 40 μv to 30,000 μv.

T–12 EMISSION OF SPURIOUS RADIO FREQUENCY ENERGY

Equipment Required

See Paragraph 1 and 2, Page 3 of Appendix A of Paper 120–61/DO–108.

Measurement Procedure

See Paragraph 3, Page 5 of Appendix A.

T–13 DAMPING CHARACTERISTIC

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Measurement Procedure

Apply to the receiver input a standard glide slope test signal of 700μv. Abruptly, change the signal from a standard *centering* signal to a standard *deviation* signal and determine the time required for the deviation indicator to move from its centered position to the point which is removed from its final stabilized position by a distance equal to 10% of standard deflection. Determine the amount the deviation indicator overshoots its stabilized position.

T–14 POWER SOURCE FREQUENCY VARIATION

This test applies to that equipment designed for operation from an AC power source of variable frequency.

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

AC power source having a frequency range equal to at least that for which the equipment is designed.

Measurement Procedure

Apply to the receiver input a standard glide slope *centering* signal having a level of 200 μv. Vary the frequency of the AC power source over the range for which the equipment is designed and determine the maximum change in deflection of the deviation indicator from its centered position.

T–15 DEVIATION INDICATOR STABILITY WITH CHANGE IN FREQUENCY OF 90 AND 150 CPS SIGNALS

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

AC power supply whose frequency may be varied over the range of 58.5 to 61.5 cps.

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input, successively, a standard glide slope *centering* signal of 700 μv and a standard glide slope *deviation* signal of 700 μv. For each rf input signal, vary the frequency of the modulation signals simultaneously over the range from 97.5% to 102.5% of 90 and 150 cps. Determine, respectively, the maximum change in deflection of the deviation indicator from its centered position and from its standard deflection position.

T–16 DEVIATION INDICATOR SENSITIVITY ADJUSTMENT RANGE

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

a. Apply to the receiver input a standard glide slope *deviation* signal of 700 μv. Determine the deviation indicator deflection when the value of the component, or components, controlling deviation indicator sensitivity are varied over the range for which the equipment is designed.

b. Conduct the tests set forth in procedures T–3, T–4, T–5, and T–6 with the deviation indicator sensitivity adjusted to the high and the low limit set forth in paragraph 2.16.

T–17 OPERATION OF TWO GLIDE SLOPE RECEIVERS FROM THE SAME ANTENNA

This test is applicable to those receivers designed to operate from an antenna which also supplies signals to another glide slope receiver.

Equipment Required

RF Signal Generator (Boonton Model 232–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Connect the receivers to the antenna transmission lines in accordance with the manufacturer's instruction.

Apply to the receiver input a standard glide slope *centering* signal of 200 μv.

Set the receiver under test to receive the standard glide slope *centering* signal. Set the other receiver(s) to all possible channel settings or combinations of channel settings and determine the maximum change in deflection of the deviation indicator from its centered position.

Repeat this test on each radio-frequency channel for which the equipment is designed.

T–18 DEVIATION INDICATOR STABILITY WITH CHANGES IN 90/150 CPS MODULATION PERCENTAGE

Equipment Required

RF Signal Generator (Boonton Model 211–A or equivalent).

AF Signal Generator (Collins Model 479S or equivalent).

Univerter (Boonton Model 212–A or equivalent).

DeviationIndicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the Deviation Indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope *centering* signal of 200 microvolts. Adjust the receiver for zero deflection of the deviation indicator. Adjust the percentage of modulation of each frequency (90 and 150 cps) to 40%. Gradually and simultaneously increase the percentage of modulation of each frequency (90 and 150 cps) to 47.5%, noting the maximum deflection of the deviation indicator.

T–19 90 AND 150 CPS PHASE CHARACTERISTICS

Equipment Required

RF Signal Generator (Boonton Model 211–A or equivalent).

AF Signal Generator (Collins Model 479S or equivalent).

Univerter (Boonton Model 212–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

A device to change the phase of either the 90 or the 150 cps signal.

Measurement Procedure

Vary the phase relationship between the 90 and 150 cps signals from that condition where the positive peaks add to a maximum to that condition where the negative peaks add to a maximum and determine the maximum change in deflection of the indicator from its centered position. (If referred to the 30 cps subharmonics of the 90 and 150 cps signals, this would be a shift of 24° between the 30 cps subharmonics.)

T–20 FREQUENCY CHANNEL SELECTION

Equipment Required

RF Signal Generator (Boonton Model 211–A or equivalent).

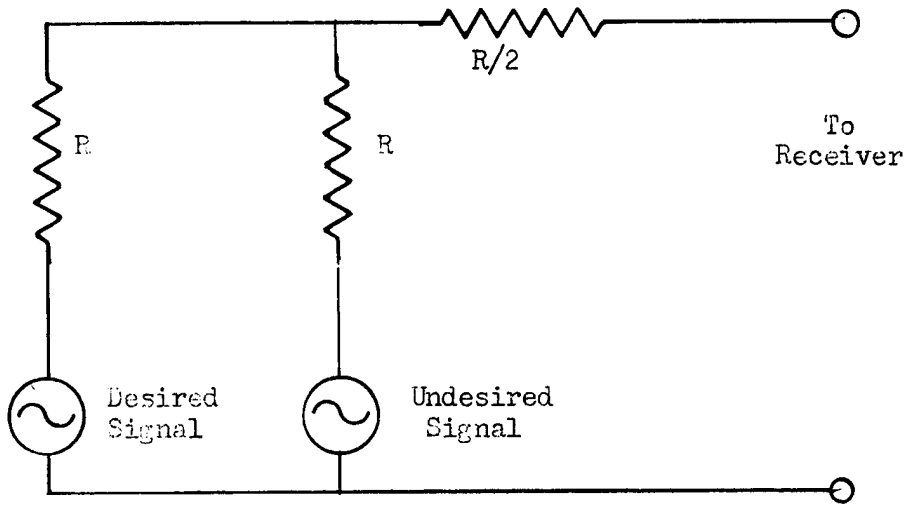
AF Signal Generator (Collins Model 479S or equivalent).

Univerter (Boonton Model 212–A or equivalent).

Deviation Indicator which will permit the required measurements to be made to an accuracy of 1%. A meter of equivalent resistance may be substituted for the deviation indicator.

Measurement Procedure

Apply to the receiver input a standard glide slope *deviation* signal and determine, for each glide slope frequency channel, the difference in kc between the center response frequency of the receiver and the assigned frequency of the respective glide slope frequency channel.



R = Characteristic impedance of the transmission line for which the receiver is designed.

FIGURE 1—Combining Unit.